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Improving performance in project-based management: synthesizing strategic theories

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Abstract

Purpose – The purpose of this paper is to explore benefits and issues of integrating the theory of constraints (TOC), resource-based view (RBV) and resource-dependence theory (RDT) with conventional project-based management frameworks.

Design/methodology/approach – Extant literature is used to develop a conceptual framework of an integrated model that will be tested for applied robustness. The model has been applied to published projects to identify its strengths and weaknesses.

Findings – The work shows important implications for improved success of projects from the use of TOC, RBV and RDT.

Research limitations/implications – While TOC, RBV and RDT are well established in the context of organization theory, there is limited application in project management. Moreover, the model has yet to be applied in the field. The hypotheses identified in this research are currently being tested using empirical investigation.

Practical implications – The research falls short in addressing some resources, e.g. innovation, tacit knowledge and decision-making methods in traditional project management context. Therefore, identifying these critical resources in future work and exploiting them as the means of improving project performance would enhance the success of project-based management.

Social implications – Project management is an emergent discipline and a project is temporary in nature. Therefore, new ideas and development of theories for project management practices are required. This innovative research, for example, may change the way projects are executed in future.

Originality/value – This paper examines the components of a successful project according to the iron triangle, i.e. scope, quality, time and cost. However, through the application of TOC, RBV and RDT into an integrated project-based management framework gives new insights to resources management.

Keywords Project management, Performance management, Theory, Resource management

Paper type Research paper

Introduction

Projects have been used to implement change, either of a physical nature or process, for several millennia, yet its management is still considered to be a relatively young discipline which lacks a fully developed theoretical base (Jugdev, 2004). However, it was only in the 1950s when organizations began to systematically apply project management methods to complex defence and construction projects that project management theory began to develop (Packendorff, as cited in Jugdev, 2004).

Today, the use of projects is increasing; particularly in the implementation of process change and productivity improvement and to implement strategies to gain competitive advantage (Shenhar and Dvir, 2007). The increased popularity of projects has given rise to a stream of literature on project management theories, approaches and processes (Collyer and Warren, 2009). Due to the multi-disciplinary nature of project management, a number of the emerging areas of study in project management are based on theories from management (Ika, 2009).

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This paper aims to contribute to the growing literature on productivity improvement using project-based management by examining three popular management theories and discussing how these theories can be applied to executing projects. The paper begins with a brief overview of the contemporary notion of project success. Thereafter, the paper introduces three management theories: the theory of constraints (TOC), the resource-based view (RBV) and resource-dependence theory (RDT), and examines how each theory can be integrated into project management to improve the likelihood of project success. Next, this paper will examine a case study of a successful project and discuss how this project demonstrates application of the three management frameworks. Finally, conclusions and limitations of the paper are discussed and future possible research is identified.

What is project success?

A key question in project management literature is how to measure project success (Wateridge, as cited in Choi *et al.*, 2011). Pinto and Slevin (as cited in Müller and Jugdev, 2012, p. 758) note "There are few topics in the field of project management that are so frequently discussed and yet so rarely agreed upon as that of the notion of project success". Traditionally, project success has been measured based on "the triple constraints" or "the iron triangle" of time, cost and scope of objectives (with quality often displayed in the centre of the triangle) (Choi *et al.*, 2011; Sebaux *et al.*, 2011). These elements are mutually dependent; therefore, a change in one will have a resultant effect on at least one other element. Over the years, the criterion for measuring project success has evolved to a more quality-based focus with greater awareness of stakeholders' needs, and inclusion of internal-external quality measures (Parker *et al.*, 2013). *A Guide to the Project Management Body of Knowledge (PMBOK Guide)* (Project Management Institute, 2013, p. 35) states project success "[…] should be measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between the project managers and senior management".

To-date, project success continues to be a topic of interest among academics and practitioners, with numerous articles continuing to be published on the definition and the importance criteria of success (Parker *et al.*, 2012). This paper will adopt the traditional definition and consider project success to be defined as achieving the "iron triangle" criteria of time, cost, scope and quality.

Project-based productivity management

The traditional approach to project management identifies a sequence of steps to be completed, which can generally be broken down into the following five components: project initiation, planning, execution, monitoring and controlling and close out (Wysocki, 2011). The *PMBOK Guide*, first developed by The Project Management Institute (PMI) in 1976, is based on this traditional approach. The *PMBOK Guide* continues to be put forth as the "generally accepted" project management practices for project managers and the *de facto* standard of the discipline (Shenhar and Dvir, 2007). The *PMBOK Guide* uses a systems approach based on inputs, processes and outputs and emphasizes the triple constraints of time, cost and scope (Jugdev, 2004).

Despite the project management industry's general acceptance of the *PMBOK* guidelines, project failure continues to be a widespread phenomenon across most industries. Surveys indicate 42 per cent of engineering projects and 81 per cent of oil

and gas projects are behind schedule (Chartered Institute of Building, as cited in Parker *et al.*, 2013), and only 32 per cent of information and communication technology (ICT) projects are successful (Standish Group CHAOS report, 2009 as cited in Kapsali, 2013). Shenhar and Dvir (2007) conducted a study of more than 600 projects in the business, government and not-for-profit sectors across various countries. The findings were that some 85 per cent of projects failed to meet time and budget goals.

One may think that project failure could be caused by poor planning, insufficient resources or lack of communication. However, Shenhar and Dvir (2007) argue that the evidence suggests failure is often found even in well-managed projects run by experienced project managers and supported by highly regarded organizations. Similarly, Sauer *et al.* (2001) note that a central aspect of ICT's approach to project management is their disciplined application of tools and techniques which has been adopted so widely and rigorously, to the point where some leading experts perceive the IT industry as the most sophisticated in project management.

Authors have begun to criticize the traditional approach to project management, arguing that this stresses predictability, which in turn places an overemphasis on planning, design and development, and is ineffective for managing projects which entail high levels of complexity and uncertainty (Kapsali, 2013; Soderlund, 2004; Sebaux *et al.*, 2011). Upon reflection of the often heard proposal for more and better project management tools, techniques and discipline, Sauer *et al.* (2001, p. 40) argue that "it seems unlikely that 'more of the same' will yield a significant improvement in performance".

Shenhar and Dvir (2007) propose that most project-based interventions are not technical but managerial, and stem from the framework and the mind-set that drive the traditional approach, rather than from a lack of processes and practices. However, the availability of resources in project delivery can be a key driver of schedule or cost overruns; with one survey concluding that 46 per cent Middle Eastern capital and infrastructure projects had suffered significant delays, and only 36 per cent of projects came in at or below budget (PricewaterhouseCoopers (PwC), 2012). Organizational capability was found to be a key concern for 47 per cent of organizations, and more than 50 per cent of projects were impacted by fundraising difficulties (PwC, 2012). While PwC's suggested remedy was improved project reporting that focused on identifying issues early, the results suggest that resource constraints are having a significant impact upon the successful delivery of projects; and therefore further investigation of the impact of resource constraints upon the process of project-based interventions would be beneficial.

This paper continues by examining three management theories and discusses how each theory can be integrated into project-based performance management to improve the likelihood of intervention success.

The TOC

The TOC was first popularized by Goldratt and Cox (1984) in the book titled *The Goal: Excellence in Manufacturing*. TOC adopts the common idiom "a chain is no stronger than its weakest link" (Tulasi and Rao, 2012); and aims to identify the core problem and develop a breakthrough solution by asking three improvement questions: What to change? What to change to? And how to cause the change? (Rand, 2000).

The TOC is based on the argument that any manageable system is restricted from achieving its objective/goal by at least one constraint (Goldratt, 1997). A five step approach is undertaken to review systems/processes, identify system constraints,

improve the capacity of the constraint and restructure the rest of the organization around it (Tulasi and Rao, 2012). This process (as cited in Rand, 2000, p. 174) includes:

(1) identify the system's constraints(s);

(2) decide how to exploit the system's constraint(s);

(3) subordinate everything else to the above decision;

(4) elevate the system's constraint(s); and

(5) if, in the previous steps, a constraint has been broken, go back to Step 1, and do not allow inertia to cause a system's constraint.

Rand (2000, p. 174) notes:

> The difference between Step 2 and Step 4 relates to the amount of investment required, whether in terms of time, effort, money, or willingness. The difference is sometimes pithily expressed as "whatever we can do tomorrow is Step 2".

The application of Step 4 may have altered the system's constraint, resulting in the previous constraint being broken and a new constraint emerging. Therefore, Step 5 involves reviewing the modified system to identify new constraints/bottlenecks. The TOC approach is therefore a process of continual improvement (Rand, 2000).

In his later novel, *Critical Chain*, Goldratt (1997) applies the TOC approach to project scheduling – referred to as "critical chain scheduling" (CCS), to reduce project duration and simplify project control (Steyn, 2002). According to Rand (2000, p. 174), *Critical Chain* was developed because of "the existence of chronic problems that existing methods, approaches and even expensive software have not been able to remove". The key elements of CCS are to focus on critical areas (i.e. critical activities and resources); avoidance of task due dates, milestones and multitasking; and insertion of various buffers at strategic points in the project schedule (Steyn, 2002; Herroelen and Leus, 2001; Millhiser and Szmerekovsky, 2012).

Whilst not discussed in further detail in this paper, Herroelen and Leus (2001, p. 560) consider CCS to be an effective project management strategy which can be deployed to avoid project delays caused by Parkinson's Law (an adage which states work expands to fill the time available for its completion), whilst protecting for Murphy's Law (i.e. uncertainty involved in the work). These views are also supported by Steyn (2002) and Rand (2000) who highlight that safety reserves are often overestimated in traditional project management approaches, which results in a tendency for project team members to procrastinate. Whilst empirical studies are lacking, authors continue to cite examples of numerous case studies of successful project execution where CCS is applied, ranging from private, public (Bevilacqua *et al.*, 2009) and government sectors (Rand, 2000; Millhiser and Szmerekovsky, 2012; Tulasi and Rao, 2012). Benefits cited include substantial time savings, profitability, customer satisfaction and worker enthusiasm.

The RBV

The RBV was conceptualized during the 1950s-1970s and is considered one of the most dominant frameworks in strategic management (Jugdev, 2004). The RBV focuses on managing limited resources in order to generate a competitive advantage. Prior (2003, p. 2) provides a more comprehensive definition, stating: "The RBV

focuses on the use and deployment of resources by a firm, the development of resource-based core competencies and the eventual competitive advantage that results from this process".

The RBV framework is commonly adopted to explain how firms can develop and sustain a competitive advantage through the application of its heterogeneous resource base (Wernerfelt, 1984). There are differences in the literature with regard to which resource characteristics are considered relevant to developing and/or sustaining a competitive advantage. In summary, resources are a source of competitive advantage if they are valuable, scarce (rare), inimitable, non-substitutable, durable, appropriate and organizational focused (Grant, 1991; Barney, 2001a; Jugdev, 2004; Jugdev and Mathur, 2013). However, in the more recent literatures (Barney, 2001b; Barney and Hesterly, 2008) the VRIO (valuable, rare, inimitable, organizational focused) framework appears to be the most commonly adopted and used in empirical studies (Jugdev, 2004; Jugdev and Mathur, 2013).

The RBV perspective also emphasizes the importance of strategic assets for developing a competitive advantage (Das and Teng, 2000). Strategic assets are often referred to as "core competencies" (Prahalad and Hamel, 1990), "organizational capabilities" (Grant, 1991) or "dynamic capabilities" (Nemati *et al.*, 2010). Strategic assets involve complex patterns of interaction and coordination between resources (including technology and people), processes and knowledge, in order to effectively transform inputs into outputs (Grant, 1991; Prior, 2003; Jugdev, 2004). Jugdev (2004) highlights that strategic assets are more important than individual resources, however, resources are essential in developing strategic assets. Jugdev (2004, p. 19) also highlights the link between strategic assets and competitive advantage, stating:

> Strategic assets involve a mix of explicit and tacit knowledge that is embedded in a company's unique internal skills, knowledge, and resources (Foss, 1997; Rumelt *et al.*, 1994). Such strengths are difficult to purchase, let alone copy, so they can contribute to a firm's ability to move beyond competitive convergence toward a competitive advantage or strategic position.

Jugdev and Mathur (2013) argue that intangible, knowledge-based resources are more likely to serve as sources of competitive advantage because they allow firms to incorporate practices into their processes that are valuable, rare, inimitable and organizational focused. Knowledge-based resources are especially difficult to imitate due to causal ambiguity, social complexity and associated firm-specificity (Teece, 1998 as cited in Jugdev and Mathur, 2013).

The RBV perspective also incorporates how organizations should assess their resources and strategic assets, and determine which should be developed and which should be de-emphasized (Grant, 1991; Prior, 2003; Jugdev, 2004). Grant (1991, p. 131) states:

> A resource-based approach to strategy is concerned not only with the deployment of existing resources, but also with the development of the firm's resource base. This includes replacement investment to maintain the firm's stock of resources and to augment resources in order to buttress and extend positions of competitive advantage as well as broaden the firm's strategic opportunity set […] Sustaining advantage in the face of competition and evolving requirements also requires that firms constantly develop their resources bases.

RDT

RDT was introduced in Pfeffer and Salancik's (2003) book titled *The External Control of Organizations: A Resource Dependence Perspective*. The RDT framework provides an

understanding of organization-environment relations and outlines the relationship (and dependencies) between resources, power and organization-environment.

RDT is often applied to explain how organizations reduce environmental interdependence and uncertainty (Hillman *et al.*, 2009). Drawing from organizational theory, RDT characterizes the organization as an open system (Ulrich and Barney, 1984), and is based on the premise that all organizations are not autonomous and are constrained by critical dependencies on other organizations for the provision of vital resources (Drees and Heugens, 2013; Pfeffer and Salancik as cited in Hillman *et al.*, 2009).

Within RDT, resources are perceived as a basis of positional power; therefore, supremacy and resource dependence are directly linked. Davis and Cobb (2010, p. 24) note that exchange-based power in RDT was derived from Emerson's (1962) parsimonious account:

> […] the power of A over B comes from control of resources that B values and that are not available elsewhere. In this account, power and dependence are simply the obverse of each other: B is dependent on A to the degree that A has power over B. Further, power is not zero-sum, as A and B can each have power over each other, making them interdependent.

Under RDT, organizations seek to manage their environments and reduce their dependencies, uncertainties and other's power over them by engaging in inter-organizational relations. Pfeffer and Salancik (as cited in Hillman *et al.*, 2009, p. 1405) note that: "Organizations inevitably never manage all external interdependencies, and any actions produce new patterns of dependence and interdependence, which in turn produce inter-organizational as well as intra-organizational power, where such power has some effect on organizational behaviour".

Davis and Cobb (2010, p. 23) identify three core ideas of the RDT framework: first, social context matters; second, organizations have strategies to enhance their autonomy and pursue interests; and third, power (not just rationality or efficiency) is important for understanding internal and external actions of organizations.

Pfeffer and Salancik (as cited in Hillman *et al.*, 2009, p. 1405) suggest the following five actions which firms can take to minimize environmental dependencies: first, mergers/vertical integration; second, joint ventures (JVs) and other inter-organizational relationships; third, boards of directors; fourth, political action; and fifth, executive succession. Organizations engage in inter-organizational arrangements to cope with interdependencies, strengthen their legitimacy and restore some degree of control (autonomy) over their environments (Davis and Cobb, 2010; Drees and Heugens, 2013). According to Santos and Eisenhardt (as cited in Drees and Heugens 2013), "Implementing such arrangements enables organizations to set their boundaries 'at the point that maximizes strategic control over crucial external forces'".

There is considerable empirical research supporting the rationale that resource dependencies are an antecedent to mergers, alliances, JVs and board interlocks (Hillman *et al.*, 2009). Hambrick *et al.* (as cited in Hillman *et al.*, 2009) note that recent research suggests that from the period between 1980 and 2000, there was considerable evidence that firms were engaged in resource-dependency relationships to reduce their overall environmental dependency.

Incorporating TOC, RBV and RDT with project-based productivity improvement

Constraints exist in all stages of a project-based performance management and include time, cost (budget), scope and quality, as well as other factors such as risks and

resource availability. Therefore, the application of the TOC to project management is important, as management of key constraints can result in reduced delays, and therefore increase the likelihood of delivering the project on-time, within budget and to scope and quality specifications.

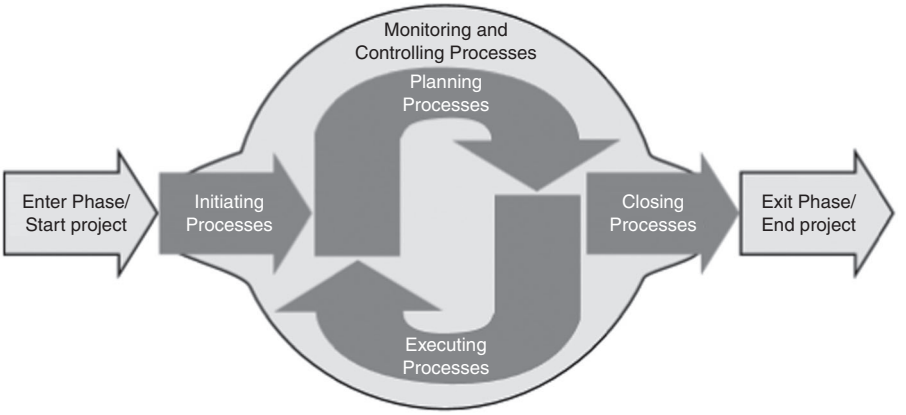
To ensure project success, project managers need to be continually on the lookout for key constraints and identify opportunities where constraints can be removed or mitigated. As noted previously, it is the projects which entail high levels of complexity and uncertainty, where traditional project management techniques have been found lacking, and are therefore more susceptible to failure (Brady and Davies, 2013). Project managers should therefore identify and manage constraints in all phases of the project and aim to reduce the levels of complexity and uncertainty, in order to minimize the potential for delays, cost blow outs, scope creep and poor quality. As noted by Tulasi and Rao (2012, p. 334) "The secret to success lies in managing these constraints and the system as it interacts with these constraints, to get the best out of the whole system".

This paper has previously discussed how the TOC methodology has been applied to project scheduling (CCS) to reduce potential delays. Similarly, Turner (as cited in Steyn, 2002, p. 78) argues that the TOC methodology can also be applied to project cost management, recognizing that work packages (like task durations) encompass cost contingencies to manage uncertainty, and should therefore be aggregated to the project level which results in a significant reduction in total project costs. This view is supported by Steyn (2002, p. 79) citing that he "doubts that there could be any fundamental reason why earned value analysis should be incompatible with TOC".

The TOC methodology can also be applied throughout the five project processes, as outlined in the *PMBOK Guide*. For example, as part of the initiation process, project managers can minimize uncertainty and risks by defining specific project objectives (including the iron triangle objectives), managing key stakeholders' expectations and developing strong communication ties with the client to identify potential, foreseeable risks. In the planning phase, project managers can minimize uncertainty and risk by employing methods/strategies which have been successful in the past, using products/materials which have been "tried and tested" and utilizing subcontractors when resources are constrained. In the monitoring and controlling phase, progress and performance can be measured against key performance indicators for time, cost, scope and quality objectives. The monitoring and controlling processes occur at the same time as other process groups, and is therefore depicted as a "background" process group in the *PMBOK Guide* (PMI, 2013), as shown in Figure 1. The TOC methodology is a process of continual improvement, therefore, it complements this process as it encourages project managers to identify constraints at each stage of the project and implement measures to address these constraints. Lastly, during the closing process, a final review of the project and documentation of "lessons learned" is conducted, which can include an overall assessment of how constraints were managed throughout the project life cycle.

The RBV perspective is also important to project-based performance management, as it focuses on the use and deployment of a firm's resources and development of strategic assets for achieving a competitive advantage. In the RBV, resources may be classified as tangible, intangible or strategic assets (Collis and Montgomery as cited in Prior, 2003).

Project management often requires application of structured and unstructured approaches involving a combination of processes that encompasses tools, techniques,



Source: *PMBOK Guide* (PMI, 2013, p. 50)

Figure 1.
Project management process groups

methodologies and best practices. Tangible resources include common project management tools, techniques, standards and practices; whilst intangible resources can include unseen assets, tacit knowledge and unique capabilities, routines and processes (Jugdev, 2004; Jugdev and Mathur, 2013).

As previously discussed, success of project-based performance improvement intervention is not always achieved by simply applying traditional tools and techniques that are recognized as good practice. Shenhar and Dvir (2007) argue that the traditional approach is based on a predictable, fixed, certain and relatively simple model; however, most projects today are uncertain, complex and changing and are strongly affected by the dynamics of the external environment. Therefore, project managers need to possess additional skills and competencies to be capable of successfully managing most modern day projects.

The *PMBOK Guide* (PMI, 2013, p. 17) states that in addition to any area-specific skills and general management proficiencies required for the project, effective project management requires that project managers possess competencies in project management knowledge, performance and personal skills. Further, effective project managers also require a balance of ethical, interpersonal and conceptual skills to help them analyse situations, interact appropriately and guide the project team, whilst simultaneously achieving project objectives and balancing project constraints (PMI, 2013). These views are also supported by Sauer *et al.* (2001) who argue that effective project managers require crucial competencies in planning, controlling, communicating, negotiating, problem-solving and leading, and combine these requisite skills with personal characteristics including experience, commitment and the need to achieve.

There is growing empirical evidence which suggests project success is directly linked to the amount of autonomy and authority project managers have over their projects (Gray and Larson, 2011). In some organizations, project outcomes may suffer due to internal competition for resources between project managers and operational managers, and competing organizational priorities. Therefore, an organization's project management capabilities also contribute directly to project success by providing a supportive context for project managers. According to Sauer *et al.* (2001, p. 41) "Organizational capability in project management is demonstrated through a complex combination of organizational arrangements and management practices including

organizational structure, role design, reporting processes, methods and procedures, focus and values, contracting relationships and human resource management". To ensure project success, Sauer *et al.* (2001) argue that organizations need to establish relevant structures and processes to support its organizational project management capability, which in turn will create a self-reinforcing dynamic and increases organizational support for the conduct of projects.

Effective project managers provide the foundation for successful project outcomes as they are ultimately responsible for achieving the project objectives. Applying RBV, organizations should focus on developing the skills of their project managers and other project team members, to ensure they possess the necessary skills and capabilities to successfully deliver projects. Furthermore, an organization's project management capability also plays an important role for project success, to provide a supportive context. Therefore, organizations need to develop their organizational project management capabilities to assist with project performance.

Finally, the RDT perspective is also important to project management as it focuses on how organizations (or project managers) can manage their external environment and reduce their dependencies and uncertainties. As previously discussed, every project is susceptible to the triple constraints of time, cost and scope. Resource availability is also another common project constraint due to factors internal and external to the organization. In order to manage these constraints, organizations regularly employ strategic tactics such as JVs, alliances, outsourcing/subcontracting and other forms of inter-organizational relationships, which can provide additional resources and assist with meeting the iron triangle objectives and delivering a successful project. Furthermore, some organizations may not possess the necessary capabilities, or may be resource constrained due to other competing projects, and may therefore choose to subcontract certain elements (i.e. such as the design component or close-out process) to other organizations which specialize in these areas.

There are numerous factors to consider when deciding whether to engage in inter-organizational relationships and which firms to engage with. Application of the RDT perspective can therefore assist by providing a more strategic approach and helping decision makers to understand their respective project environments and which resources they are dependent on from external organizations.

Hillman *et al.* (2009, p. 1417) suggests the RBV and RDT theories may complement each other given their focus on resources. Integration of these theories may provide new insights into organizational resource endowments, and explain how organizations can achieve a competitive advantage by obtaining VRIO resources from the external environment (Hillman *et al.*, 2009).

Furthermore, Hillman *et al.* (2009, p. 1417) suggest:

> Comparing these two theories allows consideration of both an internally focused perspective of how organizations specify resource needs and an externally focused perspective of how organizations obtain these valuable resources. A synthesized approach may offer insight into how obtaining control of critical resources offers firms competitive advantage and how developing resource interdependencies around critical resources affect the advantage derived from them.

Building on from this, the RBV and RDT theories can be integrated to assist decision makers in assessing the strengths and weaknesses of their resource-base and capabilities, and developing strategic relationships with other organizations which complement their strengths and weaknesses. Over time, these relationships may

eventuate into long-term partnerships, from which firms can learn from each other and enhance their capabilities.

Therefore, the TOC, RBV and RDT are important theories to project-based performance management as they provide insight into how project managers (and other key decision makers) can increase the likelihood of project-based intervention success by managing project constraints, utilizing internal resources and strategic assets and reducing dependencies and uncertainties.

Conceptual model

Planning, scheduling and mobilizing resources are key components of any project-based performance intervention. However, project managers often face situations in which key resources for the project are partially or completely unavailable. This may be due to a range of factors, including allocation of the resource to other projects or activities, or the resource being temporarily absent from the organization or the organization not possessing the required resource to begin with. If a resource is unavailable a project manager may need to delay the project until available, request additional funding to procure the resource from outside the organization or adjust the project objectives to account for the lack of capability within the project (Rand, 2000). If a scarce resource is planned to be used in the project, then obtaining the resource may require negotiation with its owners – which can significantly impact a project manager's ability to deliver the project on-time, within budget or within scope (Engwall and Jerbrant, 2003).

We deduce that project managers can increase the likelihood of a project-based performance improvement intervention success (as measured by the objectives of the "iron triangle"), by applying the TOC, RBV and RDT to manage project constraints, utilize valuable internal resources and strategic assets, and reduce dependencies by engaging in inter-organizational relationships with other organizations which complement their weaknesses. This can be applied during the initiation, planning and execution phases of a project. However, it should also be noted that the application of these theories is important at an organizational level, to improve an organization's project management capabilities.

Therefore, it is proposed that a hypothesis for testing is:

H1. If critical resources are scarce, is the project-based performance improvement intervention jeopardized?

Conversely, if an organization already possesses a key resource and does not need to compete for it in the external environment, then this will improve the likelihood that the resource will be available to be assigned to the project. Organizations can increase the likelihood of project success (as measured by the iron triangle objectives), by applying the TOC, RBV and RDT to manage internal and external factors which are constraining their projects, develop their organizational capabilities, develop their individual project managers' capabilities and develop partnerships with other firms to strengthen their project management capabilities.

This paper also discusses how the traditional approach appears to be less effective when managing projects which entail high levels of complexity and uncertainty, and how the three theories can assist with addressing these challenges.

Therefore, it is proposed that a hypothesis for testing is:

H2. Does the reliance on external resources lead to reduced project-based performance improvement?

If an organization already possesses a key resource, this is likely to improve the timeliness with which the resource can be deployed to the project. For example, if a software company already employs a system analyst specializing in development and is undertaking a development project, it is likely that the analyst will be assigned to the project in a timely manner. However, when another entity possesses these resources they may apply their power to withhold access to secure their own competitive advantage, or they may charge a premium for use of the resource thus increases project cost (Barney, 1991). Therefore, when an organization has ownership of a key resource it is less likely that the project will experience delays. However, organizations can increase the likelihood of project success (as measured by the iron triangle objectives), by applying the TOC, RBV and RDT in conjunction with traditional project management methodologies, tools and techniques to manage project complexity and uncertainty.

Accordingly, it is proposed that the following hypothesis be tested:

H3. When an organization already controls the key project resources, is the mobilization speed of key resources for the project increased?

If resources are readily available to the project team, then it is more likely that the project can be delivered in-scope and at budgeted cost. First, the likelihood of the project being delivered in-scope increases as a result of increased certainty that the required resources to deliver the project as planned are available for the project to draw upon (Rand, 2000). Second, the likelihood of the project being delivered at the budget costs will increase as there is no need to procure the required resources from the market. Thus, the potential impacts of scarcity are mitigated.

Accordingly, it is proposed that the following hypothesis be tested:

H4. When key resources are readily available for use in the project, is the project more likely to be successful?

If resources are provided to the project in a timely manner, then it is more likely that the project schedule will be less constrained and can be delivered on-time (Rand, 2000). Furthermore, it is also more likely that the project will be delivered in-scope and at budgeted cost as there will be less pressure for the project manager to cut corners or increase expenditure to improve the timeliness of the project.

Accordingly, it is proposed that the following hypothesis be tested:

H5. When key resources are supplied without delay, is the project more likely to be successful?

A conceptual schematic model (Figure 2) has been developed to synthesize the relationships between the three theories (TOC, RBT, RBV, the five project management process groups (IP, PP, EP, MCP CP) and the three dimensions of project success (scope, time, cost).

Initial testing: application to cases study

Prior to undertaking extensive empirical field research, with the underlying need for development of a range instruments for data collection – for eventual testing of the hypotheses – an exploration of conceptual and theoretical validity has been undertaken through grounding the model with a small case study. Such confirmatory reflection using published cases is an established research method (Sauser *et al.*, 2009). The case study highlight the importance of considering resource scarcity during the initiation and planning processes of a project.

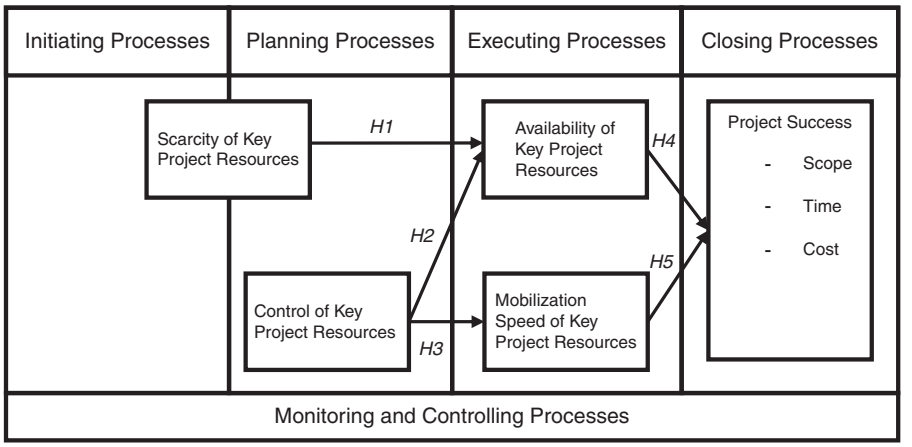


Figure 2.
Conceptual model

The following section provides an overview of London's Heathrow Terminal 5 project; and illustrates how elements of the TOC, RBV and RDT are exhibited in the project, which ultimately influenced delivery outcome.

London Heathrow Terminal 5 Airport

Despite initial problems experienced during its opening, the Heathrow Terminal 5 (T5) project is considered a success as it achieved its goals of delivering the project on time, within budget and with an exemplary safety record. A large part of its success can be attributed to British Airport Authority's (BAA) innovative approach to project delivery.

During the planning phase, the client – BAA, assembled a core team of senior managers and consultants to explore alternative practices, technologies and ideas found in other industries and megaprojects, combining these to create a new project delivery process (Davies *et al.*, 2009). The team's knowledge of other projects and project management capabilities contributed to BAA's decision to occupy the role of systems integrator for the project. As systems integrator, BAA was responsible for the management and governance through each phase of the megaproject and outsourced a large portion of design and construction activities, whilst maintaining in-house capabilities to integrate components and deliver a fully functioning system against time, cost and quality targets.

Recognizing that the majority of megaprojects are unsuccessful based on time, cost, quality and safety objectives, BAA conducted a study of previous megaprojects and airport projects and identified two key areas that contributed to poor performance: the lack of collaboration among project partners, and the client's reluctance to assume responsibility for project risk (Brady and Davies, 2013). To overcome these challenges, BAA developed a cost-plus incentive contract called the T5 Agreement, assumed full responsibility for the risk and worked collaboratively in integrated project teams with first-tier suppliers to create innovative solutions. Although many first-tier suppliers understood the benefits of collaborative teams, some were unwilling or unable to change their behaviour. Therefore, BAA implemented a large change programme to educate the supply chain and foster collaborative behaviours.

Prior to the T5 project, BAA also developed a Continuous Improvement Project Process (CIPP) which was primarily intended to improve the delivery of capital projects, with the longer-term objective being to utilize these capabilities in preparation for T5 (Davies *et al.*, 2009). The CIPP enabled BAA to develop capabilities in standardized designs (e.g. for offices and car parks) and modular components which could be used across routine projects, thereby enabling BAA to exploit the learning curve advantages and deliver cost-effective and profitable projects. The CIPP also helped BAA to understand its suppliers' capabilities and their ability to work under the environment of cooperation, trust and open-book accounting, which was later used under the T5 Agreement.

The T5 project was subject to a considerable number of project constraints, ranging from site constraints due to limited access and confined working areas, as well as over 700 conditions including restrictions on delivery and working times. To remove potential delays, BAA used pre-assembly and pre-fabrication techniques to enable suppliers to manufacture, assemble and test components, and practice their installation before being taken to the site. Just-in-time logistics were used to maintain an effective schedule of deliveries moving through the single site entrance, which was supported by the establishment of two dedicated consolidation centres for storage and materials handling located nearby. The typical risks and uncertainties associated with integration of new technologies were minimized by implementing a policy decision to use only existing or well-established technologies. Where new technologies were introduced, they were initially tested and proven either in trial or in operational environments, before being integrated into T5.

Structural complexity was mitigated by categorizing all the T5 subprojects into four main elements: buildings, rail and tunnels, infrastructure and systems. Supplier complexity (due to the multiple number of suppliers) and information asymmetries were managed by introducing a single-model environment (SME) to ensure the same information was available to all parties involved. BAA made efforts to learn from other firms that had pioneered SME technology, and carried out continuous refinements to the SME to ensure that it was implemented and used effectively during project execution. Finally, socio-political complexity was managed by implementing integrated project teams (as discussed previously) which were co-located, co-incentivized and co-responsible for the output of their projects.

Most megaprojects are unsuccessful when measured against their time, cost, quality and safety objectives (Davies *et al.*, 2009), which may be due (in part) to the high levels of complexity and uncertainty associated with these projects. However, the T5 project provides an exemplary case of how the TOC, RBV and RDT were applied in conjunction with traditional project management practices to achieve project success.

T5 supports *H1* as a key emphasis in its execution was the scrupulous management of key resources to ensure just-in-time resource availability. T5 also supports *H2* as BAA, whilst not controlling the key resources, instigated a novel and effective relationship with suppliers. Whilst BAA did not control the key resources, it ensured mobilization times were reduced, thereby supporting *H3*. Also, as explored with *H4*, tight control on resources resulted in completion within budget. Finally, T5 supports *H5* as lean and agile project management techniques allowed rapid mobility of key resources.

The T5 project has been hailed as a successful project and exhibits application of TOC, RBV and RDT to project management. The TOC methodology was applied to manage access and site constraints, reduce structural, supplier and socio-political

complexities, and improve collaboration among project partners. Potential delays and risk were also mitigated by the implementation of pre-fabrication, pre-assembly and testing of components, and just-in-time logistics. Application of the RBV is demonstrated in various aspects of the project, including BAA's introduction of its core project team, fostering of collaborative behaviours, development and utilization of standardized designs and its in-house project management capabilities. BAA's decision to take full acceptance for all project risks and implementation of a cost-plus incentive contract also assisted in improved performance, as it relieved suppliers of such burdens and encouraged innovative, collaborative behaviours. Finally, application of RDT is also demonstrated through its careful selection of first-tier suppliers and the long-term partnerships it developed with its suppliers as part of the CIPP. Given the large number of external organizations involved, BAA were able to successfully manage the systems integration by working in collaborative teams and introducing the SME.

Conclusions, limitations and future research direction

Shenhar and Dvir (2007, p. 10) argue:

> The classical drivers of project management are no longer sufficient in the current business environment. The traditional model fits only a small group of today's projects. Most modern projects are uncertain, complex and changing, and they are strongly affected by the dynamics of the environment, technology, or markets.

The London Heathrow T5 case highlights the need to incorporate an understanding of the relative scarcity of resources into the planning and execution of a project-based performance improvement intervention. Furthermore, the case study demonstrates the need for project managers to consider who controls resources in the external environment and to plan their projects to take account of these factors. Finally, the paper highlights the impact of resource availability and mobilization times upon the overall outcomes of the project, and the need for project managers to develop appropriate mitigation strategy for resource-related risks that are identified.

While the conceptual model developed in this paper has been explored using a case study, further empirical testing is required to further validate its general applicability to the management of project-based performance improvement interventions. However, regardless of the limited testing undertaken in this paper, the model presented represents an advance in providing a framework for project management that encourages research in the field beyond the current focus on optimizing internal project processes. The conceptual framework is innovative in that it grounds project management within a wider environmental context and offers opportunities for further refinement of the model to better tie the successful management of projects to improved strategic outcomes for organizations. Furthermore, the model presents an opportunity to better integrate the study of strategic management with that of performance management. It is hoped that future research and empirical studies will assist in further advancing the theories developed in this paper.

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Further reading

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